# NOTES AND BRIEF ARTICLES

[*Unsigned notes are by the editor.*]

*Owing to the increased cost of publication, the price of* MYCOLOGIA *will be advanced four dollars ($4.00) at the beginning of 1920. This price will also apply to back volumes; which can still be supplied in complete sets.*

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Dr. Charles E. Fairman, of Lyndonville, New York, spent the first part of July studying certain collections of fungi in the herbarium of the Garden. He is preparing manuscript for *North American Flora.*

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Mrs. Flora W. Patterson, mycologist of the Department of Agriculture at Washington, visited the Garden on June 24 for consultation regarding a group of fungi she is monographing for *North American Flora.*

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Dr. C. T. Gregory, who for the past six months has been employed by the Department of Agriculture as extension pathologist in the control of truck crop diseases in Indiana, has accepted the position of plant pathologist of the Virginia Truck Experiment Station, Norfolk, Virginia.

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Dr. M. F. Barrus has returned to Cornell University to resume his duties as plant pathologist after an absence of several months spent mainly in the employ of the Department of Agriculture as pathological adviser in extension work on the control of truck crop diseases in the North and West.

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Dr. W. H. Tisdale, who left the Department of Agriculture a few months ago to become plant pathologist of the North Carolina Agricultural Experiment Station, has been reinstated and

will take charge of investigations of rice diseases, with headquarters in the Washington, D. C., laboratory.

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A study of the relation of bacteria to cellulose fermentation induced by fungi with special reference to decay of wood, according to Henry Schmitz in the *Annals of the Missouri Botanical Garden* for April, shows that cellulose dissolving bacteria play no important part in the decay of wood under natural conditions. The rate of decay however is materially increased by the action of ordinary saprophytic bacteria. When autoclaved wood is used, the changes which it undergoes must be taken into consideration.—*F. J. Seaver.*

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Mrs. M. F. Wheeler, curator in the department of botany of the Massachusetts Agricultural College, visited the Garden on June 25 and 27 to examine specimens of powdery mildews collected in Massachusetts. She is preparing a bulletin on this group of parasitic fungi to appear within a few months.

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G. Arnaud, of the Station of Plant Pathology at Paris, has recently published an extensive work on the "Astérinées." The group as here considered not only includes most of the genera ordinarily included with the Perisporiales but many segregates from other orders and families. The entire work consists of 289 pages, 53 plates, a number of text-figures, and three maps. In addition to the systematic treatment, considerable space is devoted to climatology, geographic distribution, and the comparative morphology of the group.—*F. J. Seaver.*

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A check list of the fungi of Porto Rico by Mr. John A. Stevenson, formerly pathologist in the Insular Experiment Station, has recently appeared. This list contains a record of all of the species of fungi and slime molds occurring in the island so far as known up to the date of publication. The species name is accompanied by the name of the host or substratum, the locality, and the collector when not collected by a member of the staff of the experi-

ment station. The entire work consists of 129 pages and is a valuable guide to the fungous flora of the island, as well as a basis for further study.—*F. J. Seaver.*

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Dr. S. M. Zeller, who has been special investigator in timber pathology for the Southern Pine Association, of New Orleans, Louisiana, with a laboratory at the Missouri Botanical Garden, St. Louis, has been appointed investigator in fruit diseases at the Oregon Agricultural College, Corvallis, Oregon.

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Bulletin 759 of the Bureau of Plant Industry, by Fred R. Jones, deals with the leaf-spot diseases of alfalfa and red clover caused by the fungi *Pseudopeziza Medicaginis* and *Pseudopeziza Trifolii* respectively. From his investigations he concludes that the two fungi are morphologically and physiologically distinct although they have been regarded by some as being identical. Of the several imperfect fungi which have been reported as the conidial stage of this fungus, none have been found to be related and no other spore form than the ascospore form apparently exists. Infection is produced by the direct penetration of the germinating ascospores through the cuticle and epidermal wall. The fungus overwinters on the dead leaves which escape decay and ascospores produced in the spring furnish the source of new infection.—*F. J. Seaver.*

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In the report of the State Botanist of New York for 1917, just issued, Dr. H. D. House describes a new species of *Humaria* under the name of *Humaria Peckii.* The species occurs on decaying hay and is accompanied by a *Sclerotium.* In the same report a number of new species belonging to various groups are described by Dearness and House. The bulletin also contains an article by G. F. Atkinson on *Collybia campanulata* Peck and its near relatives in the eastern United States, and one by Dr. L. O. Overholts on the species of *Poria* described by Peck. The last article is illustrated by twenty-three plates.—*F. J. Seaver.*

Dr. Fred J. Seaver spent the first week of June at Ithaca, New York, collecting fungi in collaboration with Cornell University, the Brooklyn Botanic Garden, and Syracuse University. Three main excursions were made, one to Enfield Gorge, one to Laborador Lake, about forty miles from Ithaca, and one to the bogs of Mud Pond Basin near McLean. Other local trips were made in the gorges immediately adjacent to the college campus. Where necessary, transportation facilities were provided by the extension cars of the Agricultural College and the various trips were attended by a number of the graduate students and staff of the department of plant pathology under the direction of Professor H. H. Whetzel. While an exact count has not yet been made, the trip will probably add more than two hundred specimens of ascomycetes and parasitic fungi to our collection. No special attention was given to the higher fungi, since no one of the party was particularly interested in them.

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## METAPHANIC AND PROGRESSIVE VARIATION IN BEAUVERIA: ITS PHYLETIC SIGNIFICANCE

The fungi of the Conidiosporae class are subdivided into 4 groups from the spore formation: 1°, Sporotrichae, where mycelial hyphae directly yield conidia, 2°, Sporophorae, where conidia bud from sporophores, 3°, Phialidae, where conidia are formed from a differentiated bottle-like hypha called "phialida," and 4°, Prophialidae, where the phialides, instead of springing from undifferentiated vegetative hyphae, are only produced by peculiar hyphae termed "prophialides."

Daily observation of *Beauveria globulifera,* collected from mummified moths of *Cnethocampa pityocampa* in Arcachon, and cultivated in hanging drops, shows that spore formation, in this typical Philalidae, is at first a mere process of budding,—as in Sporophorae,—and differentiates to the complex conidial system of Prophialidae, as the cultures age.

1. So long as the cultures are less than 10 days old the end of the big mycelial hyphae may bud into great, oval, isolated conidia, as is only observed in Sporophorae.

2. In cultures 10 to 12 days old, undifferentiated cylindrical phialides form single, round, small conidia at the end of their thread-like summit.

3. The base of the phialide becomes swollen, while other conidia are formed basipetally below the terminal one, so that the phialide terminates into a zig-zag sporiferous thread as is typical in *Beauveria.*

4. The phialides may become forked, and yield several zig-zag sporiferous threads.

5. Phialides group by twos on vegetative hyphae, and the phialidiferous parts of the hyphae become swollen.

6. Typical phialides group into a glomerule at the end of a differentiated phialidiferous hypha, which may be termed a prophialide, such as exists in the Prophialidae.

Undifferentiated conidial threads have been interpreted by Vuillemin as regressive phialides in *B. Bassiana.* But it appears that all the conidial forms which we have recorded are normal phases of the ontogenic development of *Beauveria,* and they seem to be of phylogenetic significance, as they actually link the *Beauveria* both to the lower and to the higher Conidiosporae.[1]

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JEAN DUFRENOY

## COLLECTING FUNGI IN VIRGINIA

During the latter half of July, 1919, the writer made a tour through parts of southwest Virginia, returning by way of Blue Ridge Springs, Bedford City, Lynchburg, and Falls Church. A drought early in the month was followed by over a week of rain, which brought out an unusually large and diversified crop of

[1] We are indebted to Professors A. Guilliermond and J. Beauverie for the determination of the *Beauveria* and helpful suggestions.

fungi. These were studied and collected for several days in the vicinity of Blacksburg, Virginia, at an elevation of 2,200 feet, where the woodlands are mostly oak-chestnut and the rocks Trenton limestones or subcarboniferous shales and sandstones.

Many of the gardens, vineyards, and orchards were severely injured by the rainy weather, various wilts and rots having developed in abundance. Trees were attacked by destructive polypores, among them *Bjerkandera adusta, Coriolus versicolor, Daedalea quercina, Elfvingia lobata, Fulvifomes Robiniae, Grifolia Berkeleyi, Laetiporus speciosus, Porodaedalea Pini, Trametes robiniophila,* and *Tyromyces Spraguei.* The most abundant of these were probably *Fulvifomes Robiniae* on black locust and *Elfvingia lobata* on various species of oak, hickory, and maple. This latter species seems to entirely take the place of *Elfvingia megaloma* in that section, and its annual habit and other distinguishing characters are plainly marked.

The forest floor was covered with fungi of all kinds, this being the first and probably the largest crop of the season. Most abundant and conspicuous among the fleshy forms, was *Lactaria piperata,* growing in large patches and reaching the size of ordinary breakfast plates. *Lactaria volema* was also common, while *L. corrugis* was found only once. *Russula virescens, R. foetens, R. emetica,* and several purple species were seen, but the genus was not yet well represented.

*Venenarius phalloides, V. rubens, V. Frostianus,* and *V. solitarius* were found, but it was probably too early for *V. cothurnatus,* which was not seen in the places where it grew several years ago. The genus *Vaginata* was very well represented. *Vaginata plumbea* occurred in all color-forms; the rare *V. parcivolvata* was found twice; and *V. farinosa* once.

The Clavarias had not yet appeared; while the Hydnums were represented by *H. adustum* and *H. repandum.* Three puffballs were seen, and *Dictyophora duplicata* was unusually abundant and offensive in gardens and about bulidings. *Boletus communis, B. griseus, B. luridus, B. felleus,* and *B. bicolor* were the only members of the Boletaceae yet in evidence.

Of the fleshy forms that were eaten, the following might be mentioned: *Chanterel Chantarellus, Craterellus cornucopioides, Lycoperdon cyathiforme, L. gemmatum, Cortinarius semisanguineus, Vaginata plumbea, Lactaria volema, L. corrugis, Hydnum repandum, Boletus bicolor, Pluteus cervinus,* and *Hypomyces Lactifluorum.* Those specially avoided were species of *Venenarius* and brilliant clusters of *Clitocybe illudens.*

At Blue Ridge Springs, an unusual leaf-spot disease had almost defoliolated several box-elders and Norway maple trees, the spots being so thick on many of the leaves as to be confluent. Beneath the maples, the large diseased leaves were heaped up as though a heavy frost had occurred.

The elms at Bedford City were found to be riddled by the imported elm leaf-beetle, which, according to an observing resident physician, had been abundant there every season. No one has yet satisfactorily explained why this pest has not been seen about New York during recent years, but it may possibly have been due to adverse weather conditions.

One of the most interesting observations was made at Lynchburg, at the corner of Tenth and Harrison Streets. Here stood and English walnut tree over a hundred years old, which measured seven feet in circumference and about sixty feet in height, and had borne quantities of good nuts until about 1915. Since then, however, the nuts had been diseased and for the most part worthless. Upon closer examination, some of the green fruits hanging on the tree were seen to be partially blackened, while many entirely blackened and decayed fruits were on the ground.

The origin of this tree is unknown. It usually flowers in March and the fruit is often killed by frost. This year, however, was exceptional and the flowers appeared in February. The foliage has never been diseased. Nuts from this tree have been widely planted. A few blocks away there are two daughter trees which bear fine, healthy fruits; and the same is true of two large trees at Rustburg.

W. A. MURRILL

## SEXUALITY IN THE BASIDIOMYCETES:—A REVIEW OF

BENSAUDE, MATHILDE. Recherches Sur Le Cycle Evolutif Et La Sexualité Chez Les Basidiomycêtes. *Pp. 1–156, pl. 1–13, figs. 1–30.* Nemours, 1918.

The author of this extensive and what appears to be an exhaustive study of the nuclear phenomena in the mycelia of several Basidiomycetes brings again into the foreground the fundamental problem in the mushrooms, namely their sexual reproduction.

Miss Bensuade confirms in a measure the observations of Kniep (1915, '16, '17) who found that the clamp connections at the cross walls of hyphal cells serve the purpose of keeping the two nuclear elements of the "*dicaryon*" apart and thus insure the maintenance of two distinct lines of descent for the nuclei which fuse in the basidium. Kniep claimed that the origin of the binucleated condition is by the division of the nucleus of a uninucleated cell. Miss Bensaude argues for the sexual significance of the familiar hyphal anastomoses. Through the agency of anastomosing cells (plasmogamy or pseudogamy) the binucleated condition arises and this is perpetuated by conjugate division in connection with clamp formation till the nuclei fuse in the basidium.

The mycelia of three autobasidiomycetes, *Coprinus fimetarius* Fries, *Armillaria mucida* Schrad., and *Tricholoma nudum* Bull., were studied in considerable detail. The author found Bouin's picroformol the most satisfactory fixing agent and iron haematoxylin counterstained with eosine, light-green, or fuchsin, the most desirable staining method. The work proper may be divided into two parts: one dealing with the morphology and cytology of the mycelia in general and the other with the study of single spore cultures.

The studies of mycelia were made on spore cultures and mycelia gathered from the field. The author accepts R. Falck's classification of the mycelia into primary, secondary, and tertiary forms, and claims that during the first few days after germination the mycelium produced is primary in that the hyphae are more or less partitioned off into cells which have from one to

several nuclei, and also that in no case are clamps to be found at the cross walls. At this stage certain uninucleated cells give rise to varying numbers of oidia. Miss Bensuade claims that these oidia germinate. Disarticulated hyphal cells (*"pseudoidia"*) are also formed which may also grow into mature mycelia. Her evidence on this point is not at all convincing. Pure cultures from isolated oidia were not made. The author further claims that these oidia may fuse with a hyphal cell and thus initiate a series of binucleated cells and ultimately the development of a carpophore.

The author grew spores of *Coprinus fimetarius* in Van Tieghem cells and succeeded in removing all but one spore so that pure cultures from single spores were obtained. Ten spores were so isolated, of which four developed mycelia. These showed all the characteristics of primary mycelia. No persistent binucleated cells were found and clamp connections did not appear at the cross walls. Of these cultures, two were transferred to media where it was possible to observe their growth for about eight months. During this period these cultures showed no carpophore development and the mycelia remained of the primary type. When portions of each of these two mycelia were planted side by side, thus forming a mixed culture, the secondary mycelial type appeared and fruit bodies were shortly afterward formed. However, the author concludes that the *"dicaryon"* does not appear in monosperm cultures of *C. fimetarius* and that the binucleated cells are formed following plasmogamy between cells coming from two different thalli. The most common method of bringing about these cell fusions is through the union of an oidium with a hyphal cell of a different mycelium. The fact that Brefeld obtained carpophores from single spore cultures of *Coprinus lagopus, C. stercorarius,* etc., only leads Miss Bensaude to conclude that some basidiomycetes are homothallic and others heterothallic, resembling in this the conditions described by Blakeslee for the Mucorineae.

The author admits that transformation of a primary into a secondary mycelium is very difficult to observe, but from her study of these single spore cultures, Miss Bensaude concludes

that after the anastomosis of two hyphal cells of different thalli, the primary mycelium takes on the characteristic of the secondary one. Through this anastomosis (plasmogamy) of cells the cytoplasm as well as the nucleus or nuclei of one cell may pass into the other. The fusion of two cells with more than two nuclei generally results in the disintegration of the superfluous ones. Unfortunately, the cytological evidence offered for this most interesting claim is altogether insufficient and the figures are quite inadequate.

The most aberrant feature in the author's results is the claim that the nuclei of the early germ tube divide amitotically. Here again the evidence does not appear to be satisfactory. Two nuclei lying close together with imperfectly stained nuclear membranes do not indicate all the conclusions that the author suggests; nor in my opinion do dark or heavily stained protoplasmic strands between two nuclei suggests anything more than imperfect staining. It seems that Flemming's Strong Solution destroys the delicate spindle fibers in the fungi. The claim that in young hyphae the nuclei rarely ever show chromatin seems to be a retrogressive step in the cytology of the fungi. A number of students of the Ascomycetes, as well as the Basidiomycetes have shown rather clearly that the nuclei of the hyphae in these fungi are quite like those of higher plants.

As noted, Miss Bensaude's account of conjugate nuclear division and the formation of clamp connections agrees with that of Kniep. The nuclear division is, as a rule, preceded by the formation of a protuberance in the middle of the cell which is to develop into a clamp. The nuclei migrate into the region of the cell where this protuberance is formed. One of the nuclei which Miss Bensaude now calls plus enters this rudimentary clamp and the other minus remains in the hyphal cell. Spindles are formed lying parallel to each other and the nuclei divide. One of the plus daughter nuclei passes back into the mother cell and the other goes to the tip of the little beak. One of the minus daughter nuclei goes to the apical portion of the mother cell, the other to the basal part. Two contiguous cross walls are formed, one at the base of the young clamp and the other in the mother

cell at the level of the clamp. The apical cell so formed has a plus and a minus daughter nucleus. The basal cell has a minus nucleus and the young clamp has a plus nucleus. Fusion now occurs between the basal cell and the young clamp and the nucleus of the clamp passes into the basal cell so that it too has a minus and a plus nucleus.

At times the clamp fuses with what will be the future basal cell before the nuclei divide, so that the apical and basal cells both contain two nuclei before cell division occurs. Intercalary cells may also divide and the nuclei here also undergo conjugate division. Conjugate nuclear and cell divisions are always associated with the formation of a clamp connection. Occasionally, however, a reversion of the characteristics of secondary mycelia to those of the primary type occurs; in which case, cells are found in the secondary hyphae which have no clamps and which produce oidia.

This admission by Miss Bensaude makes us feel that the classification of the mycelia has no real basis, for uninucleated cells and binucleated cells with clamps have been observed by others, and Kniep (1915) claimed that the binucleated condition of the cells once established, it is never interrupted. The point, undoubtedly, needs further study.

Miss Bensaude's problem is a difficult one. Her work is highly commendable, for it clearly shows the necessity of working with cultures from single spores. Her figures are undoubtedly faithful representations of her preparations, but her interpretations are not adequately supported. The results she presents are theoretical possibilities but the evidence falls short of being convincing and conclusive.

MICHAEL LEVINE